

CLAIMS

[1] A pulse signal demodulation device for receiving a pulse signal converted into an optical signal via an optical transmission channel, and demodulating the pulse signal, comprising:

5 an optical-to-electrical conversion section for converting the received optical signal into an electrical signal, and outputting the electrical signal as a received signal;

a reception waveform information calculating section for outputting, as reception waveform information, information 10 about a shape of a waveform of the pulse signal on which a distortion occurring during the time from when the pulse signal is converted to the optical signal to when the optical signal is converted into the received signal by the optical-to-electrical conversion section, is reflected;

15 a template signal generating section for generating a template signal which has a waveform on which a distortion similar to the distortion occurring in the received signal is reflected, and is in synchronization with the received signal, based on the reception waveform information output from the reception waveform 20 information calculating section and a synchronization signal which is in synchronization with the received signal; and

a correlation section for demodulating the pulse signal by obtaining a correlation between waveforms of the received signal output from the optical-to-electrical conversion section and the 25 template signal generated by the template signal generating

section.

[2] The pulse signal demodulation device according to claim 1, wherein the reception waveform information calculating section 5 generates the reception waveform information based on a waveform of the pulse signal as it is transmitted, and information about the optical transmission channel.

[3] The pulse signal demodulation device according to claim 10 2, wherein the pulse signal is a short-pulse signal which occupies a frequency band having a width larger than that of a frequency band when a bit rate is converted into Hertz.

[4] The pulse signal demodulation device according to claim 15 2, wherein the reception waveform information calculating section outputs, as reception waveform information, amplitudes and phases of a frequency component corresponding to an integral multiple of a peak frequency of a spectrum of the pulse signal, and the peak frequency component, in the distortion occurring in the pulse 20 signal, and

the template signal generating section includes:

a plurality of sine wave generating sections for generating a sine wave signal having the peak frequency and a sine wave signal having a frequency which is an integral multiple of 25 the peak frequency;

a plurality of amplitude/phase adjusting sections for adjusting amplitudes and phases of the sine wave signals generated by the plurality of sine wave generating sections, based on the reception waveform information; and

5 a wave combining section for combining the sine wave signals having the amplitudes and the phases adjusted by the plurality of amplitude/phase adjusting sections.

[5] The pulse signal demodulation device according to claim
10 4, wherein the template signal generating section further includes a mask section for passing the combined signal obtained by the wave combining section, based on a hopping pattern indicating timing of a pulse to be received, to generate the template signal.

15 [6] The pulse signal demodulation device according to claim 1, wherein the pulse signal is an RZ signal.

[7] The pulse signal demodulation device according to claim 6, wherein the reception waveform information calculating section
20 outputs, as reception waveform information, amplitudes and phases of a frequency component corresponding to an integral multiple of a peak frequency of a spectrum of the pulse signal, and the peak frequency component, in the distortion occurring in the pulse signal;

25 the template signal generating section includes:

a plurality of sine wave generating sections for generating a sine wave signal having the peak frequency and a sine wave signal having a frequency which is an integral multiple of the peak frequency;

5 a plurality of amplitude/phase adjusting sections for adjusting amplitudes and phases of the sine wave signals generated by the plurality of sine wave generating sections, based on the reception waveform information;

10 a wave combining section for combining the sine wave signals output by the plurality of amplitude/phase adjusting sections; and

15 a bias section for adding a bias to the combined sine wave signal obtained by the wave combining section so that a minimum value of the combined sine wave signal is "0", and outputting the resultant signal as a template signal.

[8] The pulse signal demodulation device according to claim 2, wherein the information about the optical transmission channel includes a chirp parameter of a semiconductor laser or an optical modulator used as a transmitter for transmitting the optical signal, and a total dispersion amount of the optical transmission channel in a wavelength of the optical signal, and

25 the reception waveform information calculating section calculates a transmitted light spectrum based on a waveform of the pulse signal as it is transmitted, and a chirp parameter,

calculates a received light spectrum based on the transmitted light spectrum and the total dispersion amount of the optical transmission channel, calculates a received signal spectrum converted into an electrical signal based on the received light spectrum, and outputs information about the received signal spectrum as reception waveform information.

[9] The pulse signal demodulation device according to claim 2, wherein the correlation section outputs a calculated correlation value to the reception waveform information calculating section, and

the reception waveform information calculating section changes the information about the optical transmission channel to generate the reception waveform information, and sets the information about the optical transmission channel to be a value when the correlation value obtained by the correlation section is maximized.

[10] The pulse signal demodulation device according to claim 1, wherein the correlation section includes:

a multiplication section for multiplying the received signal with the template signal;

an integration section for calculating an integral of the signal multiplied by the multiplication section over a period of time corresponding to one bit; and

an identification section for identifying the signal integrated by the integration section, and outputting the identified value.

5 [11] The pulse signal demodulation device according to claim 1, wherein a test pulse signal converted into an optical signal is transmitted to the pulse signal demodulation device, and
the reception waveform information calculating section generates the reception waveform information based on a waveform
10 of the test pulse signal output from the optical-to-electrical conversion section.

[12] The pulse signal demodulation device according to claim 2, further comprising:
15 a storage section for storing a waveform of the pulse signal as it is transmitted, and the information about the optical transmission channel.

[13] The pulse signal demodulation device according to claim 20 12, further comprising:
an input section for inputting the waveform of the pulse signal as it is transmitted, and the information about the optical transmission channel,
wherein the storage section stores the waveform of the
25 pulse signal as it is transmitted, and the information about the

optical transmission channel which are input from the input section.